Studies in Agricultural
Capital and Technology

Economics and Sociology
Occasional Paper No. 2

The Economics of Agricultural Mechanization in Southern Brazil

A Research Proposal

by

John Stitzlein
Research Associate
Agricultural Economist

November, 1969

Department of Agricultural Economics and Rural Sociology
The Ohio State University
2120 Fyffe Road
Columbus, Ohio 43210

Dept. of Agricultural Economics
and Rural Sociology
Ohio State University

Draft 10-25-69
John Stitzlein

THE ECONOMICS OF AGRICULTURAL MECHANIZATION* IN SOUTHERN BRAZIL

A Research Proposal

The potential and desirability of mechanizing agriculture in developing nations has frequently been debated. Mechanization is often viewed as a process wherein scarce capital is substituted for unskilled labor; normally an abundant resource in underdeveloped nations. In addition to viewing mechanization as a demonstration of inefficient resource allocation, concerns are raised regarding the lack of necessary skills which operators and mechanics must possess and the supporting services and inputs which the society must provide. Other issues, somewhat less popular but perhaps just as relevant, relate to the "lumpiness" or indivisibility of tractors and accompanying equipment as inputs, the short-run effects of mechanization on the existing scarcity of foreign exchange, and the necessity of having an agrarian structure which allows the fields to be sufficiently large and accessible for mechanization.

Yet, even in the presence of such views and concerns, mechanization in the agricultural sectors of many developing nations is proceeding at a rapid pace. Illustrative of this is the number of tractors in various regions of the world for the years 1930, 1955, and 1964 (Table 1).[1/]

---

*Mechanization is used here in the popular and more narrow sense; it refers only to motorized power sources and the accompanying equipment.

1/ Although number of tractors is not an accurate measure of the degree of mechanization, it is generally used.

TABLE 1

NUMBER OF TRACTORS AND AREA OF ARABLE LAND PER TRACTOR

Region	Agricultural Tractors (Thousands)			Arable Land Per Tractor (Hectares)	
	1930	1955	1964	1955	1964
North America	1,020	5,047	5,215	45	44
Latin America	20	247	488	389	197
Africa	10	161	230	1,360	1,078
Near East	2	61	111	1,279	766
Far East	1	27	105	9,098	2,619

Source: Monthly Bulletin of Agricultural Economics and Statistics, Food and Agricultural Organization of The United Nations, Volume 15, Number 5, May, 1966, page 6.

The pace in Brazil has been more rapid than in much of the rest of Latin America. In 1950, an estimated 8,372 tractors were being used in Brazil and by 1960, the number had grown to 63,493.[2/] By the end of 1968, the number of tractors on farms had risen to approximately 100,000.[3/] Southern Brazil accounted for 6,385 and 50,821 of the tractors in 1950 and 1960, respectively.[4/]

2/ CIDA (Inter-American Committee for Agricultural Development), Land Tenure Conditions and Socio-Economic Development of the Agricultural Sector--BRAZIL, Pan American Union, OAS, Washington, 1966, Table 22.

3/ Pitcher, S., "Farm Mechanization Comes Slowly to Brazil", Foreign Agriculture, Foreign Agricultural Service/United States Department of Agriculture, July 28, 1969, Volume VII, Number 30.

4/ CIDA, Table 22.

Though the rate of increase has been rapid, the level of agricultural mechanization in Brazil is quite low. In 1968, there were an estimated 770 acres of arable land per tractor. The government of Brazil has adopted various policies in an attempt to increase the rate of mechanization of its agriculture. The Ministry of Agriculture in 1968 announced its plans to create a $150 million special government fund for the purpose of financing 93,000 tractors over the 1969-71 three-year period.[5/] In addition, the government is attempting to increase the efficiency with which the local tractor manufacturing industry operates and has reduced the rate of interest and collateral requirements on agricultural mechanization loans.[6/] Such actions are intended to reduce the costs the farmer incurs in mechanizing.

It thus appears that in spite of both the real and the potential undesirable aspects of mechanization in Brazil and in other developing countries, it has found favor among many farmers and government officials. This suggests that under certain conditions desirable aspects are felt to be present.

The study has the objective of determining and assessing the economic and other consequences associated with agricultural mechanization in southern Brazil. More specifically, the study is an attempt to determine under what individual situations and surrounding circumstances farmers should be encouraged to mechanize in southern Brazil. Changes in productivity, costs, and labor usage that occur through mechanization will be examined in detail in an effort to achieve the objective.

5/ However, due to budgetary limitations, the fund has not yet been set up.

6/ Pitcher, S., pages 5-6.

In accordance with the objective, a series of situations varying in land, labor, and capital combinations will be examined in terms of the following propositions:

1. Mechanization permits farmers to increase their total product by:
   (a) increasing the amount of land under cultivation;
   (b) increasing the intensity of land use; and
   (c) by making it possible to perform the pre-harvest and harvest operations with more precision and in a more timely fashion.
2. Mechanization enables farmers to produce their product at lower per unit costs.
3. Mechanization increases farm labor employment and productivity by:
   (a) reducing seasonal peak labor requirement for the planting and harvesting seasons;
   (b) bringing more land into production; and
   (c) increasing the intensity of land use.
4. Mechanization requires substantial new capital investments which generally cannot be adequately financed from asset liquidation or current farm income. A need for considerable supplemental external financing is apparent.

Three general types of mechanized agriculture will be identified for study in southern Brazil. The first group will contain those farms which derive the major portion of their receipts from the sale of crops and which perform some of their production tasks with the aid of the crawler type and/or the four-wheel tractor. A second group will be made up of farms which derive the major portion of their receipts from livestock sales and which employ the crawler type and/or the four-wheel

tractor in production tasks. The third group will include those farms which make use of the two-wheel and/or the tiller type tractor, but do not use larger types.

In addition, each of these three types of mechanized farms will be paired with a corresponding control group of non-mechanized farms, for comparative purposes. The general farm type (crop or livestock) along with the characteristics of the land resource will provide the primary basis for the selection of the control farms. If, however, the general characteristics appear to be too heterogenous both within and between the groups to permit comparison on a group basis, an attempt will be made to select pairs of matched farms. In each pair, one farm would be mechanized while the other would not. The six general types of farms will be examined, compared, and assessed as a means of partially evaluating the propositions.

In addition to this general comparative analysis, a case-study analysis will be developed with a small number of farms. The case-study analysis will provide the opportunity to examine more thoroughly the decision making and implementation processes which farmers go through when making the change to mechanization. They will also allow a more complete appraisal of the structural changes that occur, including the use of and need for external financing. Partial budget analysis or some similar technique will be used to identify, more specifically, situations under which various degrees of mechanization should be encouraged.